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(54) Title: WIRELESS COMMUNICATIONS SYSTEM, BASE STATION DEVICE, AND PORTABLE WIRELESS EQUIPMENT

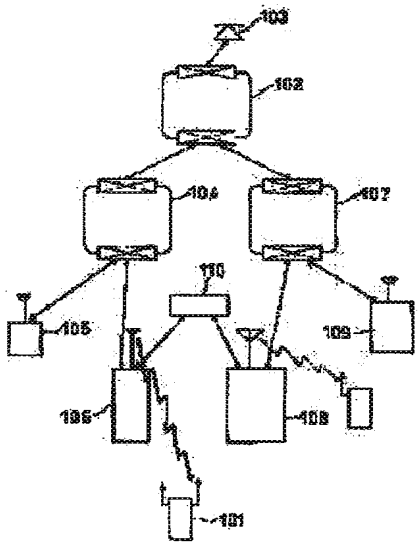
(57) Abstract

Problem

To provide a wireless communications system, base station device, and portable wireless equipment, that can quickly switch between different systems.

Means to solve

A base station 108 of system B sends monitor information, such as the occupied state of a wireless channel in a service area, and system information of a control channel or the like used by base station 108 to base station 106 of an adjacent or overlapping system A. In addition to the information of system A, the information of system B sent from base station 108 is also sent as control information from base station 106 to multimode portable equipment 101. Multimode portable equipment 101 can use the information of system B to quickly connect to the base station 108 of system B.



Claims

1. A wireless communications system equipped with the base station of a first system and the base station of a second system different from the first system and having a service area that is adjacent to or overlaps the service area of the base station of the first system, characterized by the fact that each of the base station of the first system and the base station of the second system has a means used for sending its own information to the base station of the other system, and a means that can include information of the other system sent from the base station of the other system in the control signals of its own system, and can send the signals to portable wireless equipment that can communicate by using both said first system and second system.

2. A base station device characterized by the fact that a base station, which belongs to a first system of a wireless communications system comprised of plural systems and has a service area adjacent to or overlapping the service area of a base station of a second system different from the first system, has a means that sends information of the first system to the base station of the second system.

3. A base station device characterized by the fact that a base station, which belongs to a first system of a wireless communications system comprised of plural systems and has a service area adjacent to or overlapping the service area of a base station of a second system different from the first system, has a means that includes the information of the second system sent from the base station of the second system in the control signals of the first system and sends the signals to portable wireless equipment that can communicate by using both said first system and second system.

4. Portable wireless equipment that can communicate by using both a first system and a second system characterized by having a means that receives control signals including information of the second system from a base station of the first system, a means that notifies that connection with said second system is possible when the control signals including the information of the second system are received by said means, and a storage means that stores the information of said second system.

5. The portable wireless equipment described in Claim 4 characterized by having a means that terminates a communication or call waiting state of the first system and uses the information of the second system stored in said storage means to connect to the second system when the control signals including the information of the second system are received.

Detailed explanation of the invention

[0001]

Technical field of the invention

The present invention pertains to a wireless communications system having portable wireless equipment that can communicate using two or more different systems and to a base station device and the portable wireless equipment.

[0002]

Prior art

Currently, various wireless communications systems, such as cellular phones and cordless phones, are available, and are classified corresponding to the region or application. Examples of so-called dual mode or multimode portable devices that can use plural different systems using one portable equipment item include CDMA type and analog type dual mode portable phones in the United States and the dual system of PDC (personal digital cellular) and satellite telephones in Japan, which have been put into practical application.

[0003]

Additionally, practicalization of a dual mode system of the GSM (global system for mobile communications) as the most popular cellular system in the world that was revealed in 1997 Electronic Information Communication Association B-5-141 and of the PHS (personal handyphone system) that has been adopted in Japan and is superior in the aspects of cost and high-speed communication is under study.

[0004]

However, since plural systems are accessed at the same time in the aforementioned multimode portable device, the characteristics are harmed by mutual interference in portable devices, and processing on the network side is complicated. Therefore, it is necessary to select one of the plural systems in practical application.

[0005]

The operation of a portable device in said multimode system will be explained based on Figure 4. In this case, in order to facilitate explanation, two systems, that is, system A and system B are used. In Figure 4, 401 represents a multimode portable device, 402 represents the network of system A, 403 and 404 represent the base stations of areas 405 and 406 of system A, 407 represents the network of system B, and 408 and 409 represent the base stations of the areas 410 and 411 of system B.

[0006]

Multimode portable device 401, for example, has a wireless part for system A and a wireless part for system B and can receive services by using both systems A and B.

[0007]

In Figure 4, multimode portable device 401 is in the service circle of system A and communicates or waits for an incoming call on the side of system A. However, since area 406 is positioned at the end inside the service circle of system A (edge area), if the user of multimode portable device 401 moves further in the direction indicated by arrow 412, it is necessary for multimode portable device 401 to switch service from system A to system B.

[0008]

The user can manually switch the system when notified from base station 404 that area 406 is the area of system A. However, if multimode portable device 401 moves out of the circle of area 406 and it is unable to receive service from base station 404, multimode portable device 401 can switch the system by automatically establishing a link with base station 408. Nevertheless, in either case, connection with the base station 408 on the side of system B is performed after connection with the base station 404 on the side of system A is ended.

[0009]

To realize connection, first, it is necessary to receive a control signal sent from each base station. In the PDC, GSM, or other existing cellular phone system, however, fixed channels #1, #2, #3, #4 are assigned as channels for transmitting said control information to base stations 501, 502, 503, 504, respectively, as shown in Figure 5. Plural channels are present in the entire system. Also, in normal system connection, since individual base stations do not have the information of the channels used for transmitting the control signal, it is necessary for multimode portable device 401 to first scan all control channels in order to find the control channel of base station 408 as the connection target.

[0010]

Consequently, in the conventional method, time is required to find the control channel needed for reconnection to another system and to obtain the control information. Also, service cannot be received from either of the systems during that period.

[0011]

Problems to be solve by the invention

As described above, in the aforementioned conventional multimode system, since each system is independent and information is not transferred between them, time is required to obtain information of the system as the switching destination or to set the equipment. As a result, time is required to switch the system.

[0012]

The objective of the present invention is to solve the aforementioned problem by providing a wireless communications system, a base station device, and wireless portable equipment that can obtain the base station, area of the switching destination and other system information in advance even when switching between different systems and use said information to quickly switch the system.

[0013]

Means to solve the problems

The present invention provides a wireless communications system equipped with a base station of a first system and a base station of a second system different from the first system and having a service area that is adjacent to or overlaps the service area of the base station of the first system. Both the base station of the first system and the base station of the second system has a means used for sending its own information to the base station of the other system, and a means that can include the information of the other system sent from the base station of the other system in the control signals of its own system and send the signals to portable wireless equipment that can communicate by using both said first system and second system.

[0014]

In the wireless communications system with the aforementioned configuration, when switching is carried out between different systems, since the base station, area, and other system information of the switching destination can be obtained in advance, said information can be used to quickly perform system switching.

[0015]

The present invention also provides a base station device characterized by the fact that a base station, which belongs to a first system of a wireless communications system comprised of plural systems and has a service area adjacent to or overlapping the service area of the base

station of a second system different from the first system, has a means that sends information of the first system to the base station of the second system.

[0016]

The present invention also provides a base station device characterized by the fact that a base station, which belongs to a first system of a wireless communications system comprised of plural systems and has a service area adjacent to or overlapping the service area of the base station of a second system different from the first system, has a means that includes the information of the second system sent from the base station of the second system in the control signals of the first system and sends the signals to portable wireless equipment that can communicate using both said first system and second system.

[0017]

The present invention also provides portable wireless equipment that can communicate by using both a first system and a second system characterized by having a means that receives control signals including information of the second system from the base station of the first system, a means that notifies that connection with said second system is possible when control signals including the information of the second system are received by said means, and a storage means that stores the information of said second system.

[0018]

Said portable wireless equipment has a means that terminates a communication or call waiting state of the first system and uses the information of the second system stored in said storage means to connect to the second system when control signals including the information of the second system are received.

[0019]

Embodiment of the invention

In the following, an embodiment of the present invention will be explained in detail with reference to the figures. In the following figures, the same symbols represent the same or corresponding parts, respectively. An embodiment of the wireless communications system disclosed in the present invention will be explained below.

[0020]

In this embodiment, in order to simplify the explanation, switching between two systems will be explained. Figure 1 shows the configuration of the system in this embodiment.

[0021]

In this figure, 101 represents a multimode portable device, 102 represents a wired network, 103 represents a wired telephone set, 104 represents the network of system A, 105 and 106 represent the base stations of system A, 107 represents the network of system B, 108 and 109 represent the base stations of system B, and 110 represents a relay device.

[0022]

Figure 2 shows an example of the configuration of multimode portable device 101. In this figure, 201 represents the wireless part of system A having antenna 202 for system A, 203 represents the wireless part of system B having antenna 204 for system B, 205 represents a control part having storage part 206, 207 represents an interface part, 208 represents a microphone, 209 represents a speaker, 210 represents a display, and 211 represents a keypad.

[0023]

Multimode portable device 101 establishes a link with the base station 106 of system A to communicate or wait for an incoming call. Base station 106 monitors the occupied state or information of the position registration of the wireless channel in the service area at appropriate times. The system information of the control channel used by base station 106 [is added] to said monitor information and the result is transmitted via relay device 110 to base station 108 of system B that is adjacent to or overlaps base station 106. On the other hand, for base station 108 on the side of system B with an area adjacent to or overlapping base station 106, similarly, information of the control channel used by base station 108 is added to the monitor result, such as the occupied state or the information of the position registration of the wireless channel in its own service area, and the result is transmitted via relay device 110 to base station 106. In this case, relay device 110 is used to send information between different systems. It is also possible to adopt a mechanism that can send and receive information with respect to the base station of the other system for base stations 106, 108 instead of using relay device 110 to send/receive information directly between base stations 106 and 108.

[0024]

In addition to information regarding the area of system A or the peripheral area as control information sent from base station 106, information regarding system B sent from base station 108 is also transmitted to multimode portable device 101.

[0025]

When multimode portable device 101 receives a control signal including information of a different system from the system that is currently connected, the fact that it is possible to switch to said other system is informed as an audio signal from speaker 209 or is displayed on display 210. Also, the received information is stored in storage part 206 provided in control part 205. Consequently, multimode portable device 101 can use the stored received information to switch the system.

[0026]

System switching is carried out, for example, as follows. First, a manual switching method will be described. When the user of multimode portable device 101 instructs switching to another system, that is, system B, using a switch or the like on keypad 211, multimode portable device 101 ends the connection to the base station 106 on the side of system A. Then, it tries to establish a connection with the base station 108 on the side of system B. In this case, since it is the same as establishing a new connection with respect to system B, the connection is established in the same procedure used when the power is turned on. However, since the control channel [sic; information] used by base station 108 is transmitted through base station 106 as described above and the information is stored in storage part 206, it is possible to upload and receive information regarding the control channel of base station 108 from storage part 206 immediately without scanning all control channels of system B in order to find the control channel of base station 108.

[0027]

It is also possible to switch the system automatically instead of using a manual method. That is, when it is possible to switch to another system, that is, system B as multimode portable device 101 receives a control signal including the information of a different system, that is, system B, the communication or call waiting state with system A, that is, the system established at the current time point is maintained, and the signal of the control channel of base station 108 of another intermittently switchable system, that is, system B, is received, and the received electrical field intensity of the signal is measured. Then, the received electrical field strength of the signal from base station 106 that is connected is compared. If the signal intensity from base station 108 of system B is higher than that of base station 106, the system will be switched.

[0028]

In this case, system switching can be carried out automatically with no instruction from the user. The procedure of ending the link with base station 106 and establishing the connection

with base station 108 is the same as in the manual method. The user can also set the switching judgment condition. For example, the user can set ① a number of consecutive switching times if the number of times that the measured received electrical field strength of another system is higher is more than a certain number of times (or a duration time of switching when the higher state lasts for a certain period of time) or ② the level difference if the level difference of the received electrical field strength is greater than a certain value as said switching judgment condition.

[0029]

Additionally, the information of the occupied state of the wireless channels or position registration included in the system information is used to comprehend the use situation of base station 108. If an empty channel is not present in base station 108, a message indicating that system switching is difficult will be displayed. If there is another connectable base station candidate, that base station will be displayed. If necessary, it is also possible to try to establish connection with said base station.

[0030]

Figure 1 shows a case in which the information between the systems is transmitted between base stations. However, it is also possible to set up a transmission path 301 for transmitting information between the networks of the systems, that is, network 104 of system A and network 107 of system B as shown in Figure 3. If a special pipe is not adopted as shown in Figures 1, 3, it is also possible to transmit information via another network to which both of the systems are connected, such as the PSTN (public network).

[0031]

Also, in the aforementioned explanation, switching is performed when the service areas of the base stations of two systems are adjacent or overlap each other. It is also possible to apply the present invention in the same way when the service areas of the base stations of three or more systems are adjacent or overlap each other when the base stations of different systems transmit the information of each system to each other.

[0032]

Effect of the invention

As explained above, it is possible to switch between different systems reliably and quickly by using the wireless communications system of the present invention.

Brief description of the figures

Figure 1 is a block diagram illustrating the system configuration of an embodiment of the present invention.

Figure 2 is a block diagram illustrating the configuration an example of a multimode portable device.

Figure 3 is a block diagram illustrating the system configuration of another configuration of the present invention.

Figure 4 is a diagram explaining the configuration and system switching of a multimode system.

Figure 5 is a diagram explaining the relationship between a base station and the control channel used by each base station.

Explanation of the reference symbols

101	Multimode portable device
102	Wired network
103	Wired telephone set
104	Network of system A
105, 106	Base station of system A
107	Network of system B
108, 109	Base station of system B
110	Relay device
201	Wireless part for system A
202	Antenna for system A
203	Wireless part for system B
204	Antenna for system B
205	Control part
206	Storage part
207	Interface part
208	Microphone
209	Speaker
210	Display
211	Keypad
301	Transmission path
401	Multimode portable device
402	Network of system A
403, 404	Base station of system A

405, 406	Area of system A
407	Network of system B
408, 409	Base station of system B
410, 411	Area of system B
501, 502, 503, 504	Base station

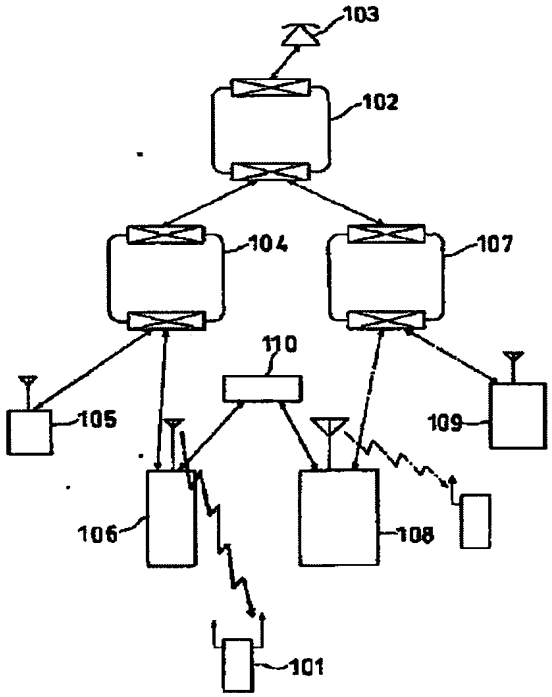


Figure 1

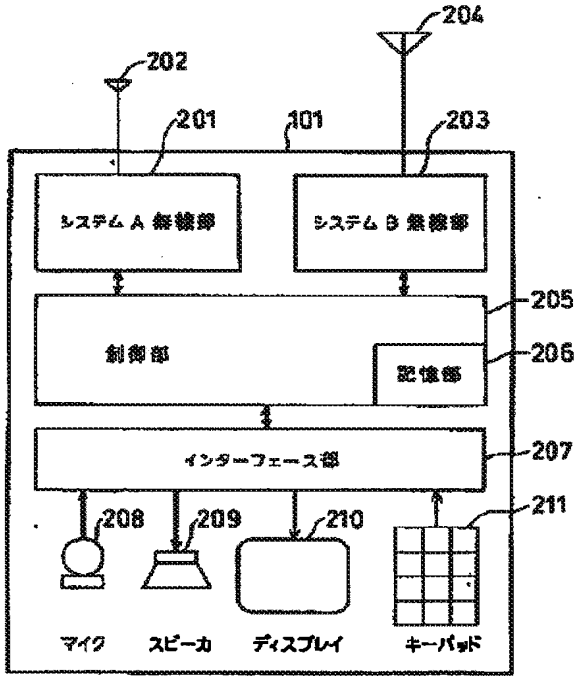


Figure 2

Key:
201 Wireless part for system A
203 Wireless part for system B
205 Control part
206 Storage part
207 Interface part
208 Microphone
209 Speaker
210 Display
211 Keypad

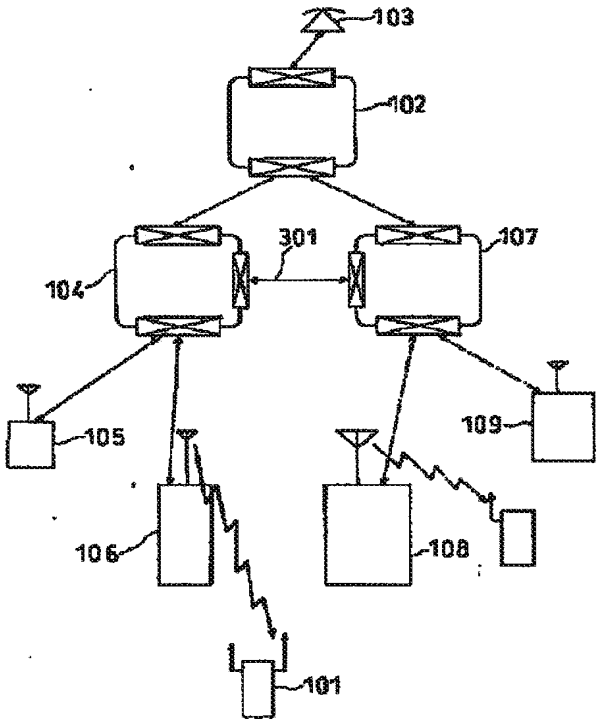


Figure 3

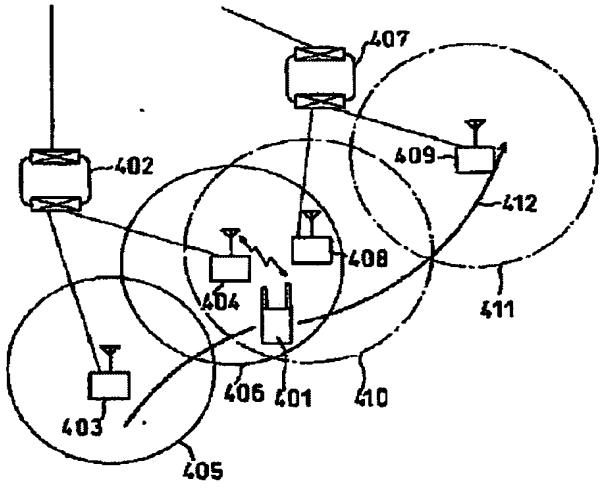


Figure 4

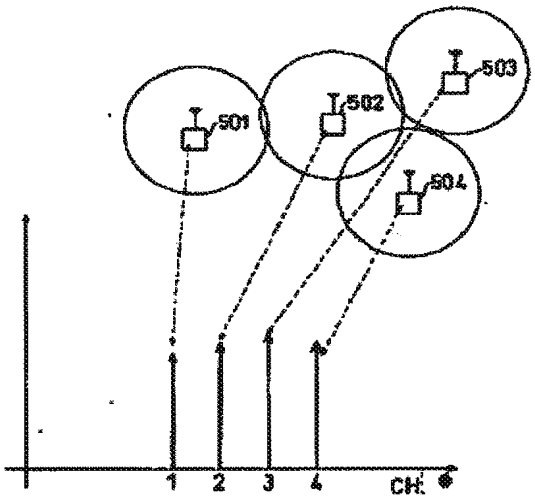


Figure 5